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APPLICATION NUMBER: 60/488,484

FILING DATE: July 17, 2003

RELATED PCT APPLICATION NUMBER: PCT/US03/34347

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FEE RECORD SHEET

07/22/2003 HTECKLU1 00000075 502518 60488484
01 FC:1005 160.00 DA

PTO-1556
(5/87)

*U.S. Government Printing Office: 2002 — 489-267/68033

16711 U.S. PTO
07/17/03

Honeywell Reference No. H0005631 (4900)
Practitioner's Docket No. 51-155-001

PATENT

Preliminary Classification

Proposed Class:
Subclass:

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of: Wei T. HUANG; Joseph KENNEDY; and Ronald R. KATSANES

For: PLANARIZATION FILMS FOR ADVANCED MICROELECTRONIC APPLICATIONS AND
DEVICES AND METHODS OF PRODUCTION THEREOF

Mail Stop Provisional Patent Application
Commissioner for Patents
PO Box 1450
Alexandria, VA 22313-1450

23002 U.S. PTO
60/488484
07/17/03

COVER SHEET FOR FILING PROVISIONAL APPLICATION
(37 C.F.R. SECTION 1.51(c)(1))

This is a request for filing a PROVISIONAL APPLICATION FOR PATENT under 37 C.F.R. section 1.51(c)(1)(i). The following comprises the information required by 37 C.F.R. Section 1.51(c)(1):

CERTIFICATION UNDER 37 C.F.R. SECTION 1.10*

(Express Mail label number is mandatory.)

(Express Mail certification is optional.)

I hereby certify that this correspondence and the documents referred to as attached therein are being deposited with the United States Postal Service on July 17, 2003 (date), in an envelope as "EXPRESS MAIL POST OFFICE TO ADDRESSEE" service under 37 C.F.R. Section 1.10, Mailing Label Number EV332879204US addressed to the Assistant Commissioner for Patents, Washington, D.C. 20231.

Kristin J. Azcona

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Each paper or fee filed by "Express Mail" must have the number of the "Express Mail" mailing label placed thereon prior to mailing. 37 C.F.R. Section 1.10(b).
"Since the filing of correspondence under [Section] 1.10 without the Express Mail mailing label thereon is an oversight that can be avoided by the exercise of reasonable care, requests for waiver of this requirement will not be granted on petition." Notice of Oct. 24, 1996, 60 Fed. Reg. 56,439, at 56,442.

(Cover Sheet for Filing Provisional Application--page 1 of 3)

1. The names of the inventors are (37 C.F.R. Section 1.51(c)(1)(ii)):
 1. Wei T. HUANG
 2. Joseph KENNEDY
 3. Ronald R. KATSANES
2. Residence addresses of the inventors, as numbered above (37 C.F.R. Section 1.51(c)(1)(iii)):
 - 1.
 - 2.
 - 3.
3. The title of the invention is (37 C.F.R. Section 1.51(c)(1)(iv)):

PLANARIZATION FILMS FOR ADVANCED MICROELECTRONIC APPLICATIONS AND DEVICES AND METHODS OF PRODUCTION THEREOF
4. The name, registration, customer and telephone numbers of the practitioner are (37 C.F.R. Section 1.51(c)(1)(v)):

Name of practitioner: Sandra P. Thompson
Reg. No. 46264
Tel. No. 714-433-2622
5. The docket number used to identify this application is (37 C.F.R. Section 1.51(c)(1)(vi)):

Docket No. 51-155-001
6. The correspondence address for this application is (37 C.F.R. Section 1.51(c)(1)(vii)):

Sandra Poteat Thompson
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7. Statement as to whether invention was made by an agency of the U.S. Government or under contract with an agency of the U.S. Government. (37 C.F.R. Section 1.51(c)(1)(viii)).

This invention was NOT made by an agency of the United States Government, or under contract with an agency of the United States Government.

(Cover Sheet for Filing Provisional Application--page 2 of 3)

8. Identification of documents accompanying this cover sheet:

A. Documents required by 37 C.F.R. Section 1.51(c)(2)-(3):

Specification:	No. of pages	13
Drawings and Attachment:	No. of sheets	0

B. Additional documents:

None

9. Fee

The filing fee for this provisional application, as set in 37 C.F.R. Section 1.16(k), is \$160.00 for other than a small entity.

10. Fee payment

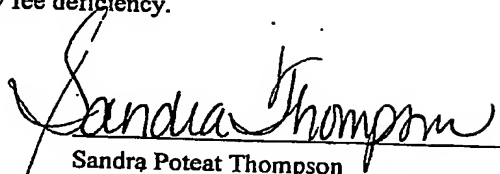
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11. Method of fee payment

Check in the amount of \$160.00.

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Date: July 17, 2003


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(Cover Sheet for Filing Provisional Application--page 3 of 3)

PLANARIZATION FILMS FOR ADVANCED MICROELECTRONIC APPLICATIONS AND DEVICES AND METHODS OF PRODUCTION THEREOF

To meet the requirements for faster performance, the characteristic dimensions of features of integrated circuit devices have continued to be decreased. Manufacturing of devices with smaller feature sizes introduces new challenges in many of the processes conventionally used in semiconductor fabrication. One of the challenges of producing microelectronic devices and using them in various applications is the global planarization of a surface having a non-planar surface topography.

Planarization of a surface generally comprises utilizing one or both of two different actions: a) adding to the surface, or b) subtracting from the surface. The action of subtracting from the surface usually means that the surface is polished or otherwise physically or chemically etched in order to remove any unwanted surface topography and minimize/remove any gaps. The action of adding to the surface usually means adding another layer to the surface topography to fill any gaps and create a smooth surface.

Planarization by addition is not satisfactory where the film thickness measured at the open field area is substantially greater than that at the surface of the topography. If the film thickness difference between the topography and open field area is too large, a high risk of yield loss at the final device develops. One of the polymer solutions that experiences some problems when comparing the film thickness measured at the open field area to that at the surface of the topography is a novolac-based polymeric solution. Novolac-based polymer solutions contemplated herein are those disclosed in US Issued Patents: 6,506,831; 6,506,441; 6,517,951; US Patent Application Serial No.: 10/299,127 and related and corresponding foreign and PCT applications, including PCT/US99/30296, which are all incorporated herein in their entirety and are commonly owned and assigned to Honeywell International Inc. Other contemplated novolac-based polymer solutions are those disclosed in the following references: Rahman et al. (US 5,853,954 and US 5,910,559); Malik et al. (US 6,027,853); Allen et al. (SPIE Vol. 2438, pp. 250-260); Tsiartas et al. (SPIE Vol. 2438, pp. 261-271) or Sizensky et al (US 5,413,894), which are all incorporated herein by reference.

In order to improve the gap-filling and planarization abilities of a solution that comprises monomers or other non-polymer species and/or a polymeric solution, the solution should be modified in order to modify the viscosity and the surface energy of the solution. In several cases, it is beneficial to lower both the viscosity and the surface energy in order to optimize the gap-filling and planarization properties. One way to modify the polymeric solution is to modify and/or replace the solvent solution. For example, in a novolac-based polymeric solution, a strongly hydrogen-bonding solvent is used to dissolve the surfactant that is added to the polymeric solution. In one instance, the strongly hydrogen-bonding solvent is ethyl lactate and the surfactant is a fluoroaliphatic polymeric ester surfactant. For this case, the strongly hydrogen-bonding solvent can be replaced by a co-solvent system comprising an alcohol, such as 2-propanol and propylene glycol methyl ether acetate (PGMEA). Without being bound to any particular theory, it is believed that the solubility of fluoroaliphatic polymeric ester surfactant in 2-propanol is similar to that of PGMEA however superior to ethyl lactate. In addition, 2-propanol possesses weaker intermolecular forces and lower surface tension than ethyl lactate. The capillary flow in narrow trenches is affected by the molecular structure and associated electrical charge. Representing integral effects of surface forces, the apparent viscosity of moderately polar 2-propanol decreases from its nominal value at narrow trench regime, where the ratio between apparent and nominal viscosity for ethyl lactate is larger than that of 2-propanol. Addition of PGMEA to 2-propanol in the co-solvent system for the surfactant reduces the evaporation rate difference between 2-propanol and bulk PGMEA used for cresol-novolac resin dilution.

As used herein, the term "monomer" refers to any chemical compound that is capable of forming a covalent bond with itself or a chemically different compound in a repetitive manner. The repetitive bond formation between monomers may lead to a linear, branched, super-branched, or three-dimensional product. Furthermore, monomers may themselves comprise repetitive building blocks, and when polymerized the polymers formed from such monomers are then termed "blockpolymers". Monomers may belong to various chemical classes of molecules including organic, organometallic or inorganic molecules. The molecular weight of monomers may vary greatly between about 40 Dalton and 20000 Dalton.

However, especially when monomers comprise repetitive building blocks, monomers may have even higher molecular weights. Monomers may also include additional groups, such as groups used for crosslinking.

Contemplated solvents are those that include any suitable pure or mixture of organic molecules that are volatilized at a desired temperature and/or easily solvates the chosen surfactants, polymers and/or other molecules discussed herein. Contemplated solvents are also those solvents that can, alone or in combination, modify the viscosity and surface energy of the solution in order to improve the gap-filling and planarization properties. The solvent may also comprise any suitable pure or mixture of polar and non-polar compounds. As used herein, the term "pure" means is composed of a single molecule or compound. For example, pure water is composed solely of H_2O . As used herein, the term "mixture" means that component that is not pure, including salt water. As used herein, the term "polar" means that characteristic of a molecule or compound that creates an unequal charge, partial charge or spontaneous charge distribution at one point of or along the molecule or compound. As used herein, the term "non-polar" means that characteristic of a molecule or compound that creates an equal charge, partial charge or spontaneous charge distribution at one point of or along the molecule or compound.

A layered component is also contemplated herein and comprises: a substrate having a surface topography; a planarization solution and/or film as described herein, wherein the film and/or material is coupled to the substrate; and optionally at least one additional layer of material or film. Contemplated coating materials, coating solutions and films can be utilized are useful in the fabrication of a variety of electronic devices, micro-electronic devices, particularly semiconductor integrated circuits and various layered materials for electronic and semiconductor components, including hardmask layers, dielectric layers, etch stop layers and buried etch stop layers. These coating materials, coating solutions and films are quite compatible with other materials that might be used for layered materials and devices, such as adamantane-based compounds, diamantane-based compounds, silicon-core compounds, organic dielectrics, and nanoporous dielectrics. Compounds that are considerably compatible with the coating materials, coating solutions and films contemplated herein are disclosed in

PCT Application PCT/US01/32569 filed October 17, 2001; PCT Application PCT/US01/50812 filed December 31, 2001; US Application Serial No. 09/538276; US Application Serial No. 09/544504; US Application Serial No. 09/587851; US Patent 6,214,746; US Patent 6,171,687; US Patent 6,172,128; US Patent 6,156,812, US Application Serial No. 60/350187 filed January 15, 2002; and US 60/347195 filed January 8, 2002, which are all incorporated herein by reference in their entirety.

Surfaces contemplated herein may comprise any desirable substantially solid material, such as a substrate, wafer or other suitable surface. Some contemplated surfaces comprise a non-planar surface topography and other contemplated surfaces have already been planarized. Particularly desirable substrate layers would comprise films, glass, ceramic, plastic, metal or coated metal, or composite material. Surface and/or substrate layers comprise at least one layer and in some instances comprise a plurality of layers. In preferred embodiments, the substrate comprises a silicon or germanium arsenide die or wafer surface, a packaging surface such as found in a copper, silver, nickel or gold plated leadframe, a copper surface such as found in a circuit board or package interconnect trace, a via-wall or stiffener interface ("copper" includes considerations of bare copper and its oxides), a polymer-based packaging or board interface such as found in a polyimide-based flex package, lead or other metal alloy solder ball surface, glass and polymers such as polyimide. In more preferred embodiments, the substrate comprises a material common in the integrated circuit industries as well as the packaging and circuit board industries such as silicon, copper, glass, and another polymer. Suitable surfaces contemplated herein may also include another previously formed layered stack, other layered component, or other component altogether. An example of this may be where a dielectric material and CVD barrier layer are first laid down as a layered stack – which is considered the "surface" for the subsequently spun-on layered component.

At least one layer is coupled to the surface or substrate. As used herein, the term "coupled" means that the surface and layer or two layers are physically attached to one another or there's a physical attraction between two parts of matter or components, including bond forces such as covalent and ionic bonding, and non-bond forces such as Van der Waals, electrostatic, coulombic, hydrogen bonding and/or magnetic attraction. Also, as used herein,

the term coupled is meant to encompass a situation where the surface and layer or two layers are directly attached to one another, but the term is also meant to encompass the situation where the surface and the layer or plurality of layers are coupled to one another indirectly – such as the case where there's an adhesion promoter layer between the surface and layer or
5 where there's another layer altogether between the surface and layer or plurality of layers.

As used herein, the term "low dielectric constant" means a dielectric constant measured at 1 MHz to 2 GHz, unless otherwise inconsistent with context. It is contemplated that the value of the dielectric constant of a low dielectric constant material or layer is less than about 3. In a preferred embodiment, the value of a low dielectric constant material or
10 layer is less than about 2.5. In a more preferred embodiment, the value of a dielectric constant material or layer is less than about 2.

Contemplated dielectric and low dielectric materials comprise inorganic-based compounds, such as silicon-based disclosed in commonly assigned US Patent 6,143,855 and pending US Serial No. 10/078919 filed February 19, 2002; (for example Honeywell
15 NANOGLASS® and HOSP® products), gallium-based, germanium-based, arsenic-based, boron-based compounds or combinations thereof, and organic-based compounds, such as polyethers, polyarylene ethers disclosed in commonly assigned US Patent 6,124,421 (such as Honeywell FLARE™ product), polyimides, polyesters and adamantane-based or cage-based
20 compounds disclosed in commonly assigned WO 01/78110 and WO 01/08308 (such as Honeywell GX-3™ product). The dielectric and low dielectric materials may be applied by spin coating the material on to the surface, rolling the material on to the surface, dripping the material on to the surface, and/or spreading the material on to the surface.

The layered component contemplated herein may also comprise a diffusion blocking material that is not on the component in the form of a layer, but is instead being used to
25 "block" any individual pores/voids and not to cover the entire underlying layer. In some embodiments, the diffusion blocking material will react with the underlying low k dielectric material or layer and in other embodiments, The diffusion blocking material will not be reactive with the underlying low k dielectric material or layer. In other embodiments the diffusion blocking layered component contemplated may consist of a densified layer of the

low k material or contain phase separated elements of the low k material densified in such a manner as to block diffusion of species. Diffusion blocking materials, such as those contemplated herein, can be found in commonly-owned US Provisional Application 60/385482 filed on June 3, 2002, which is incorporated herein in its entirety.

5 Other spin-on materials may be utilized in additional layers of the layered component. Several of the contemplated spin-on materials are described in the following issued patents and pending applications, which are herein incorporated by reference in their entirety: (PCT/US00/15772 filed June 8, 2000; US Application Serial No. 09/330248 filed June 10, 1999; US Application Serial No. 09/491166 filed June 10, 1999; US 6,365,765 issued on 10 April 2, 2002; US 6,268,457 issued on July 31, 2001; US Application Serial No. 10/001143 filed November 10, 2001; US Application Serial No. 09/491166 filed January 26, 2000; PCT/US00/00523 filed January 7, 1999; US 6,177,199 issued January 23, 2001; US 6,358,559 issued March 19, 2002; US 6,218,020 issued April 17, 2001; US 6,361,820 issued March 26, 2002; US 6,218,497 issued April 17, 2001; US 6,359,099 issued March 19, 2002; 15 US 6,143,855 issued November 7, 2000; and US Application Serial No. 09/611528 filed March 20, 1998).

Solutions of organohydridosiloxane and organosiloxane resins can be utilized for forming caged siloxane polymer films that are useful in the fabrication of a variety of electronic devices, micro-electronic devices, particularly semiconductor integrated circuits 20 and various layered materials for electronic and semiconductor components, including hardmask layers, dielectric layers, etch stop layers and buried etch stop layers. These organohydridosiloxane resin layers are quite compatible with other materials that might be used for layered materials and devices, such as adamantane-based compounds, diamantane-based compounds, silicon-core compounds, organic dielectrics, and nanoporous dielectrics. 25 Compounds that are considerably compatible with the organohydridosiloxane resin layers contemplated herein are disclosed in PCT Application PCT/US01/32569 filed October 17, 2001; PCT Application PCT/US01/50812 filed December 31, 2001; US Application Serial No. 09/538276; US Application Serial No. 09/544504; US Application Serial No. 09/587851; US Patent 6,214,746; US Patent 6,171,687; US Patent 6,172,128; US Patent 6,156,812, US

Application Serial No. 60/350187 filed January 15, 2002; and US 60/347195 filed January 8, 2002, which are all incorporated herein by reference in their entirety.

Organohydridosiloxane resins utilized herein have the following general formulas:

- | | | |
|---|---|-------------|
| 5 | $[H-Si_{1.5}]_n[R-SiO_{1.5}]_m$ | Formula (1) |
| | $[H_{0.5}-Si_{1.5-1.8}]_n[R_{0.5-1.0}-SiO_{1.5-1.8}]_m$ | Formula (2) |
| | $[H_{0-1.0}-Si_{1.5}]_n[R-SiO_{1.5}]_m$ | Formula (3) |
| | $[H-Si_{1.5}]_x[R-SiO_{1.5}]_y[SiO_2]_z$ | Formula (4) |

10 wherein:

the sum of n and m, or the sum of x, y and z is from about 8 to about 5000, and m or y is selected such that carbon containing constituents are present in either an amount of less than about 40 percent (Low Organic Content = LOSP) or in an amount greater than about 40 percent (High Organic Content = HOSP); R is selected from substituted and unsubstituted, 15 normal and branched alkyls (methyl, ethyl, butyl, propyl, pentyl), alkenyl groups (vinyl, allyl, isopropenyl), cycloalkyls, cycloalkenyl groups, aryls (phenyl groups, benzyl groups, naphthalenyl groups, anthracenyl groups and phenanthrenyl groups), and mixtures thereof; and wherein the specific mole percent of carbon containing substituents is a function of the ratio of the amounts of starting materials. In some LOSP embodiments, particularly favorable 20 results are obtained with the mole percent of carbon containing substituents being in the range of between about 15 mole percent to about 25 mole percent. In some HOSP embodiments, favorable results are obtained with the mole percent of carbon containing substituents are in the range of between about 55 mole percent to about 75 mole percent.

25 Nanoporous silica dielectric films with dielectric constants ranging from 1.5 to about 3.8 can be also as at least one of the layers. Nanoporous silica compounds contemplated herein are those compounds found in US Issued Patents: 6,022,812; 6,037,275; 6,042,994; 6,048,804; 6,090,448; 6,126,733; 6,140,254; 6,204,202; 6,208,041; 6,318,124 and 6,319,855.

These types of films are laid down as a silicon-based precursor, aged or condensed in the presence of water and heated sufficiently to remove substantially all of the porogen and to form voids in the film. The silicon-based precursor composition comprises monomers or prepolymers that have the formula: R_x-Si-L_y , wherein R is independently selected from alkyl groups, aryl groups, hydrogen and combinations thereof, L is an electronegative moiety, such as alkoxy, carboxy, amino, amido, halide, isocyanato and combinations thereof, x is an integer ranging from 0 to about 2, and y is an integer ranging from about 2 to about 4. Other nanoporous compounds and methods can be found in US Issued Patents 6,156,812; 6,171,687; 6,172,128; 6,214,746; 6,313,185; 6,380,347; and 6,380,270, which are incorporated herein in their entirety.

The phrases "cage structure", "cage molecule", and "cage compound" are intended to be used interchangeably and refer to a molecule having at least 10 atoms arranged such that at least one bridge covalently connects two or more atoms of a ring system. In other words, a cage structure, cage molecule or cage compound comprises a plurality of rings formed by covalently bound atoms, wherein the structure, molecule or compound defines a volume, such that a point located within the volume can not leave the volume without passing through the ring. The bridge and/or the ring system may comprise one or more heteroatoms, and may be aromatic, partially saturated, or unsaturated. Further contemplated cage structures include fullerenes, and crown ethers having at least one bridge. For example, an adamantane or diamantane is considered a cage structure, while a naphthalene or an aromatic spirocompound are not considered a cage structure under the scope of this definition, because a naphthalene or an aromatic spirocompound do not have one, or more than one bridge.

Contemplated cage compounds need not necessarily be limited to being comprised solely of carbon atoms, but may also include heteroatoms such as N, S, O, P, etc. Heteroatoms may advantageously introduce non-tetragonal bond angle configurations. With respect to substituents and derivatizations of contemplated cage compounds, it should be recognized that many substituents and derivatizations are appropriate. For example, where the cage compounds are relatively hydrophobic, hydrophilic substituents may be introduced to increase solubility in hydrophilic solvents, or vice versa. Alternatively, in cases where polarity is

desired, polar side groups may be added to the cage compound. It is further contemplated that appropriate substituents may also include thermolabile groups, nucleophilic and electrophilic groups. It should also be appreciated that functional groups may be employed in the cage compound (e.g., to facilitate crosslinking reactions, derivatization reactions, etc.) Where the
5 cage compounds are derivatized, it is especially contemplated that derivatizations include halogenation of the cage compound, and a particularly preferred halogen is fluorine.

Cage molecules or compounds, as described in detail herein, can also be groups that are attached to a polymer backbone, and therefore, can form nanoporous materials where the cage compound forms one type of void (intramolecular) and where the crosslinking of at least
10 one part of the backbone with itself or another backbone can form another type of void (intermolecular). Additional cage molecules, cage compounds and variations of these molecules and compounds are described in detail in PCT/US01/32569 filed on October 18, 2001, which is herein incorporated by reference in its entirety.

As mentioned earlier, some additional layers may comprise a plurality of voids and/or
15 pores in one or all of the dielectric layers or low dielectric constant layers. This plurality of voids can also be expressed by using the phrase "nanoporous layer". As used herein, the term "nanoporous layer" refers to any suitable low dielectric material (i.e. ≤ 3.0) that is composed of a plurality of voids and a non-volatile component. As used herein, the term "substantially" means a desired component is present in a layer at a weight percent amount greater than 51%.
20 As used herein, the word "void" and/or "pore" means a volume in which mass is replaced with a gas. Appropriate gases include relatively pure gases and mixtures thereof, including air. It is contemplated that any one of the spin-on layers may comprise a plurality of voids. Voids/pores may have any suitable shape. Voids may be spherical, tubular, lamellar, discoidal, or other shapes. It is also contemplated that voids may have any appropriate
25 diameter. It is further contemplated that voids have some connections with adjacent voids to create a structure with a significant amount of connected or "open" porosity. In preferred embodiments, voids have a mean diameter of less than 100 nanometers. In more preferred embodiments, voids have a mean diameter of less than 10 nanometers. And in still more preferred embodiments, voids have a mean diameter of less than one nanometer. It is further

contemplated that voids may be uniformly or randomly dispersed within any one of the spin-on layers.

As used herein, the term "metal" means those elements that are in the d-block and f-block of the Periodic Chart of the Elements, along with those elements that have metal-like properties, such as silicon and germanium. As used herein, the phrase "d-block" means those elements that have electrons filling the 3d, 4d, 5d, and 6d orbitals surrounding the nucleus of the element. As used herein, the phrase "f-block" means those elements that have electrons filling the 4f and 5f orbitals surrounding the nucleus of the element, including the lanthanides and the actinides. Preferred metals include indium, silver, copper, aluminum, tin, bismuth, gallium and alloys thereof, silver coated copper, and silver coated aluminum. The term "metal" also includes alloys, metal/metal composites, metal ceramic composites, metal polymer composites, as well as other metal composites. As used herein, the term "compound" means a substance with constant composition that can be broken down into elements by chemical processes.

Additional layers of material may be coupled to the layered component in order to continue building a layered component or printed circuit board. It is contemplated that the additional layers will comprise materials similar to those already described herein, including metals, metal alloys, composite materials, polymers, monomers, organic compounds, inorganic compounds, organometallic compounds, resins, adhesives and optical wave-guide materials.

A layer of laminating material or cladding material can be coupled to the layered interface materials depending on the specifications required by the component. Laminates are generally considered fiber-reinforced resin dielectric materials. Cladding materials are a subset of laminates that are produced when metals and other materials, such as copper, are incorporated into the laminates. (Harper, Charles A., *Electronic Packaging and Interconnection Handbook*, Second Edition, McGraw-Hill (New York), 1997.)

Spin-on layers and materials may also be added to the layered interface materials or subsequent layers. Spin-on stacked films are taught by Michael E. Thomas, "Spin-On

Stacked Films for Low k_{eff} Dielectrics", *Solid State Technology* (July 2001), incorporated herein in its entirety by reference.

5 Examples of other additional layers of materials comprise metals (such as those which might be used to form via fills or printed circuits and also those included in US Patent No. 5,780,755; 6,113,781; 6,348,139 and 6,332,233 all of which are incorporated herein in their entirety), metal diffusion layers, mask layers, anti-reflective coatings layers, adhesion promoter layers and the like.

10 The compounds, coatings, films, materials and the like described herein may be used to become a part of, form part of or form an electronic component and/or semiconductor component. As used herein, the term "electronic component" also means any device or part that can be used in a circuit to obtain some desired electrical action. Electronic components contemplated herein may be classified in many different ways, including classification into active components and passive components. Active components are electronic components capable of some dynamic function, such as amplification, oscillation, or signal control, which
15 usually requires a power source for its operation. Examples are bipolar transistors, field-effect transistors, and integrated circuits. Passive components are electronic components that are static in operation, i.e., are ordinarily incapable of amplification or oscillation, and usually require no power for their characteristic operation. Examples are conventional resistors, capacitors, inductors, diodes, rectifiers and fuses.

20 Electronic components contemplated herein may also be classified as conductors, semiconductors, or insulators. Here, conductors are components that allow charge carriers (such as electrons) to move with ease among atoms as in an electric current. Examples of conductor components are circuit traces and vias comprising metals. Insulators are components where the function is substantially related to the ability of a material to be
25 extremely resistant to conduction of current, such as a material employed to electrically separate other components, while semiconductors are components having a function that is substantially related to the ability of a material to conduct current with a natural resistivity between conductors and insulators. Examples of semiconductor components are transistors, diodes, some lasers, rectifiers, thyristors and photosensors.

Electronic components contemplated herein may also be classified as power sources or power consumers. Power source components are typically used to power other components, and include batteries, capacitors, coils, and fuel cells. Power consuming components include resistors, transistors, integrated circuits (ICs), sensors, and the like.

5 Still further, electronic components contemplated herein may also be classified as discreet or integrated. Discreet components are devices that offer one particular electrical property concentrated at one place in a circuit. Examples are resistors, capacitors, diodes, and transistors. Integrated components are combinations of components that that can provide multiple electrical properties at one place in a circuit. Examples are integrated circuits in
10 which multiple components and connecting traces are combined to perform multiple or complex functions such as logic.

 In a more specific example, about 1 gram of fluoroaliphatic polymeric ester surfactant was dissolved at room temperature and pressure in a co-solvent of about 4.5 grams of propylene glycol monomethyl ether acetate and about 4.5 grams of 2-propanol. About 10
15 grams of low molecular weight cresol novolac-based resin (MW = about 1500, Mn = 800) was dissolved under ambient conditions in about 15 grams propylene glycol monomethyl ether acetate. A loading of about 5% in weight of such fluoroaliphatic polymeric ester surfactant solution is added to low-molecular weight, low polydispersity cresol novolac-based resin solution and further diluted with about 10 grams of propylene glycol monomethyl ether
20 acetate. This formulated mixture is applied to patterned substrate by spin coating. Subsequent to propylene glycol monomethyl ether acetate surface-conditioning, the nozzle moves from wafer edge to center and the solution is radially applied to the substrate, which is then spun at gradually increased speeds ranging from about 100 RPM to about 2500 RPM. The coated substrate is placed in two hot plates at a temperature of about 160°C and about 200°C for
25 about 90 seconds each.

 By using these modified polymeric solutions, the thickness difference between the topography and open field area has been significantly reduced and 100% improvement in film planarization property has been achieved.

Thus, specific embodiments, methods of formation and applications of modified planarization solutions have been disclosed. It should be apparent, however, to those skilled in the art that many more modifications besides those already described are possible without departing from the inventive concepts herein. The inventive subject matter, therefore, is not to
5 be restricted except in the spirit of the disclosure herein. Moreover, in interpreting the specification, all terms should be interpreted in the broadest possible manner consistent with the context. In particular, the terms "comprises" and "comprising" should be interpreted as referring to elements, components, or steps in a non-exclusive manner, indicating that the referenced elements, components, or steps may be present, or utilized, or combined with other
10 elements, components, or steps that are not expressly referenced.